Mutiple layered membrane with thin fluorine containing polymer layer

DESCRIPTION

[Para 1] FIELD OF THE INVENTION

[Para 2] This patent applies to the cross-linking of a thin film layer of 0.3mm or less uncured Fluoroelastomer, typically comprised of a copolymer of of vinylidene fluoride and hexafluoropropylene or terpolymers of vinylidene fluoride, hexafluoropropylene and tetrafluoroethylene, onto a substrate such as EPDM or Nitrile rubber to improve upon the substrate's physical and chemical resistance properties. This method is especially interesting in applications where temperature or chemical resistance properties of a fluoroelastomer are favored, but the physical properties of a different material are required. A clear example of this is the waste water aeration market, where flexible EPDM membranes having desirable physical properties but lackluster chemical resistance may now be layered with a flexible fluoroelastomer to inhibit substrate material degradation.

[Para 3] BACKGROUND OF THE INVENTION

There are existing methods to bond fluoroelastomers to substrate materials such as EPDM and Nitrile. However these methods have not proven successful in applications where the material is subject to significant stress, such as bending, perforating, doming, and stretching. In the waste water aeration market, for example, membranes are perforated and continuously stretched and flexed. The method of connecting multiple layers must be a strong and permanent one to survive this kind of application.

[Para 4]

It is well known that monopolymeric rubber membranes made non fluoroelastomers lack desirable chemical and physical properties of fluoroelastomers such as temperature resistance, mechanical and physical functions, and chemical resistance.

[Para 5]

Likewise fluoroelastomers are limited in elongation, flexibility, strength, modulus, hardness and other physical properties.

[Para 6]

Therefore the ideal combination adopts the desirable characteristics of both fluoroelastomers and non fluoroelastomers.

[Para 7]

One specific example of an application for this technology is in the diffused aeration business, where perforated rubber membranes, submerged in either chemical or municipal waste water, are flexed continuously in order to produce a multitude of fine bubbles. The fine bubbles transfer oxygen efficiently from gas to liquid phase. Such membranes traditionally have been subject to attack by wastewater contents which are relatively common, such as fats, oils, greases, aromatic hydrocarbons, calcium carbonate deposits on the water side of the membrane, and ozone or oxygen attack on the air side of the membrane. Through the use of a multiple layered membrane it is possible to maintain the well established physical properties of today's EPDM membranes while adding a protective fluoroelastomer shield at an economical cost.

[Para 8] SUMMARY

It has been documented in U.S. Pat. No. 6,759,129 that a fluoropolymer layer may be bonded to a second layer through the aid of a fluoroelastomer bonding

solution. However we have proven that it is not necessary to use a bonding agent to attach thin fluoroelastomer film to a substrate such as EPDM or Nitrile rubber through the use of a three stage cross linking method.

[Para 9] Through the use of the three stage cross linking method it is possible to form a permanent bond directly between the thin fluoroelastomer film layer and the substrate layer which can withstand significant stretching, perforating, and flexing of the joined article without failure.

[Para 10] DESCRIPTION OF DRAWINGS

FIG. 1 is a cross sectional view of a multi-layer article.

FIG. 2 is a cross sectional view of a compression mold base with a membrane onto which layers are being applied.

FIG. 3 is a cross sectional view of a membrane onto which layers have been applied.

[Para 11] DETAILED DESCRIPTION

Adhesion between multiple polymer layers where a thin fluoroelastomer film 1 is joined with a substrate 2 is accomplished in a novel way through a three step molding process.

[Para 12] As a first step, a substrate layer such as membrane 2 is pre-cured to an incomplete state of cure at a temperature of 75 to 150 degrees C in a mold base 4.

[Para 13] As a second step, an uncured thin fluoroelastomer film 1 of less than or equal to 0.3mm is placed on the substrate layer 2 and the layers are cured together in the mold 4 at a temperature of 150 to 250 degrees C. The

short exposure to high temperatures necessary to cure fluoroelastomers quickly cross links the fluroelastomer layer to the substrate layer without harming the substrate. Referring to FIG. 1, article 5 is the cross linked zone between substrate and thin fluoroelastomer film.

[Para 14] As a third step, the joined article is removed from the mold base 4 and placed into an autoclave at a temperature of 100 to 180 degrees C where the state of cure of the substrate material is raised to 90-95%.

[Para 15] From the foregoing it will be seen that this invention is one well adapted to attain all ends and objects hereinabove set forth together with the other advantages which are obvious and which are inherent to the structure.

[Para 16] It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

[Para 17] Since many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative, and not in a limiting sense.